

We claim:

- 1        1. An apparatus for removing a bottom cover on a coke drum, the apparatus  
2 comprising:  
3              a support structure that supports at least the coke drum;  
4              a vertical actuator having a cover end attached to the bottom cover and a  
5 support end attached to said support structure, wherein said vertical actuator is arranged to  
6 move the bottom cover vertically in a removal operation of the bottom cover;  
7              a rotating actuator having a cover end attached to the bottom cover and a  
8 support end attached to said support structure and arranged to rotate the bottom cover in a  
9 removal operation; and  
10             a frame assembly having opposing ends, a pivoting end being attached to the  
11 bottom cover and a sliding end being slidably mounted such that said frame assembly, said  
12 vertical actuator and said rotating actuator cooperate to remove the bottom cover in a  
removal operation.
- 1        2. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, wherein said vertical actuator is attached to the bottom cover and the support  
3 structure by way of pivot joints that allow pivoting about at least two orthogonal axes.

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1        3. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 2, wherein said rotating actuator is attached to said support structure by way of a  
pivot joint that is adapted to allow pivoting about only one axis.

1        4. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, further comprising a floor actuator attached to the sliding end of said frame  
3 assembly, said floor actuator and said frame assembly cooperating in order to remove the  
bottom cover only vertically.

1        5. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, further comprising a floor actuator configured to move the sliding end of said  
frame assembly during a removal operation.

1        6. An apparatus for removing a bottom cover on a coke drum according to  
claim 1, wherein said vertical actuator and said floor actuator are hydraulic cylinders.

1        7. An apparatus for removing a bottom cover on a coke drum according to  
claim 1, wherein said frame assembly is directly attached to the bottom cover.

1        8. An apparatus for removing a bottom cover on a coke drum according to  
claim 1, wherein said frame assembly is indirectly attached to the bottom cover.

1        9. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, further comprising a connecting plate fixed to the bottom cover, wherein the  
pivot end of said frame assembly is pivotally attached to said connecting plate.

1        10. An apparatus for removing a bottom cover on a coke drum according to  
claim 9, wherein said rotating actuator is pivotally attached to said connecting plate.

1        11. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, further comprising a floor attachment assembly configured to slidably mount the  
sliding end of said frame assembly.

1        12. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, further comprising a floor attachment assembly, said floor attachment assembly  
3 comprising:  
4              an anchor attached to the floor and having a sidewall, the sidewall having an  
5 aperture;  
6              a slide block slidably disposed within the aperture of the sidewall; and  
7              a pin interconnecting said anchor and the sliding end of said frame  
8 assembly,  
such that said slide block and said anchor slidably secure said frame assembly to the floor.

1        13. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, wherein said frame assembly and said rotating actuator cooperate to  
simultaneously lift and rotate the bottom cover during a removal operation.

1        14. An apparatus for removing a bottom cover on a coke drum according to  
2 claim 1, wherein said rotating actuator and said frame assembly are pivotally attached to  
3 the bottom cover at the same location, such that as said rotating actuator supplies a force to  
4 said frame assembly, said frame assembly rotates in an arc and the bottom cover is  
simultaneously rotated and lifted during a removal operation.

1        15. A method of removing a bottom cover on a coke drum, the method  
2 comprising the steps of:  
3              supporting at least the coke drum using a structure;  
4              providing a vertical actuator having a cover end attached to the bottom cover  
5 and a support end attached to the support structure, wherein the vertical actuator is  
6 arranged to move the bottom cover vertically in a removal operation;  
7              providing a rotating actuator having a cover end attached to the bottom  
8 cover and a support end attached to the support structure;  
9              providing a frame assembly having opposing ends so that a pivoting end is  
10 attached to the bottom cover and a sliding end is slidably mounted; and  
11              actuating the vertical actuator and sliding the sliding end of the frame  
assembly to move the bottom cover only vertically.

16. A method of removing a bottom cover on a coke drum according to claim 15, further comprising actuating the rotating actuator such that the frame assembly rotates at the sliding end of the frame assembly and the bottom cover is simultaneously rotated and lifted.